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Fluidization process in submarine landslides due to water infiltration caused the high mobility of debris flows

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In various environments, sudden variation in pore water pressure in the vicinity of shear surfaces can trigger a landslide. Landslides occurred in the subaqueous environments often involve huge amount of fine-grained sediments and cover large travelling distance, indicating that some are much bigger than any seen on-land. From the geotechnical and rheological points of view, this research would focus on the phase “transition from slide to flow”. The landslide fluidization due to water infiltration into the soil was studied by physical and numerical means. After the onset of slope failure, the failed mass might be experienced large deformation with ambient water – soil breaking into many pieces of soil blocks during shearing – and then turbidity current could be produced. During the transition phase, the interaction between sediments and water may thus play an important role in characterizing the mobility of debris flows and their deposition pattern. In fact, in slip surface, loss in shear strength in weakened slopes is related to the change in density and water content of landslide body. Mechanically, based on a strain softening behavior in clayey soils, shear strength suddenly decreases with increasing deformation or time, corresponding to increasing water content in slip surfaces. Preliminary findings have revealed that there is the strength evolution from intact through remoulded toward residual/yield strength of failed materials with the help of Cat-scanning image techniques and laboratory/hand-held vanes. Particularly for, under undrained condition, the case that fine-grained soils governed the landslide mobilization, the effect of water infiltration into soil is of great importance. In parallel with experimental evidence, the numerical simulation using dam-break concept were carried out in terms of landslide fluidization – dynamic interaction between soil particles and ambient water can lead soil fluidization. The model originally developed by Robert and Pagnacco in Laval University was used. This simple 2-D model included: continuity equation, Navier-Stokes equation, transport equation, and coupling equation between density of mud and water concentration. At the moment of failure, or just after, we look into the influence of the component of velocity and mud concentration on the acceleration of landslide motion. The acceleration of solid bodies may move inside the fluid domain and possibly generate landslide-induced water waves – sometimes called landslide tsunamis.